**Cardiopulmonary risks and conditions**

 Cardiopulmonary diseases encompass a range of conditions that affect the heart and lungs, and they include cardiovascular diseases (such as coronary artery disease, heart failure, and stroke) as well as respiratory diseases (such as chronic obstructive pulmonary disease, asthma, and pulmonary hypertension)

**Cardiopulmonary risks**

1. **Unhealthy diet.** Unhealthful dietary intake is a significant risk factor for the development and progression of cardiopulmonary diseases. For example, consuming a diet which is highly saturated and trans fats can lead to elevated levels of LDL (low-density lipoprotein) cholesterol, commonly known as "bad" cholesterol. High levels of LDL cholesterol contribute to the formation of plaque in the arteries, increasing the risk of atherosclerosis and coronary artery disease.
2. **High Blood pressure.** High blood pressure can damage the inner lining of arteries, making them more susceptible to the buildup of plaque (atherosclerosis). This buildup narrows the arteries, reducing blood flow and increasing the risk of heart disease and stroke. Hypertension can affect smaller arteries throughout the body, including those in the lungs. This can contribute to the development of pulmonary hypertension and increase the workload on the right side of the heart. High blood pressure can cause dysfunction in the endothelium, the inner lining of blood vessels. Endothelial dysfunction is associated with inflammation and impaired vascular function, contributing to the development of cardiovascular diseases.
3. **Smoking**. Smoking is a significant contributor to the development of atherosclerosis, a condition where fatty deposits (plaque) build up on the walls of arteries, narrowing them. This can lead to coronary artery disease, increasing the risk of heart attacks and angina (chest pain). Smoking also increases the risk of blood clot formation, which can block blood vessels and lead to heart attacks or strokes.
4. **Obesity**. Obesity is a significant risk factor for the development of cardiopulmonary diseases. The impact of obesity on this system is complex and multifaceted. Adipose tissue (fat) produces inflammatory substances, contributing to a state of chronic inflammation in the body. Inflammation is a key factor in the development and progression of atherosclerosis. Obesity places an increased workload on the heart to pump blood throughout the body. Over time, this can lead to structural changes in the heart and contribute to heart failure.

 Obesity places an increased workload on the heart to pump blood throughout the body. Over time, this can lead to structural changes in the heart and contribute to heart failure. Obesity is a major risk factor for OSA, a condition in which the upper airway becomes partially or completely blocked during sleep. OSA is associated with an increased risk of hypertension, heart disease, and stroke. Obesity is a primary risk factor for the development of type 2 diabetes. Diabetes, in turn, is a significant contributor to cardiovascular diseases.

1. **Diabetes.** Diabetes is associated with an increased risk of atherosclerosis, a condition characterized by the buildup of plaque in the arteries. This plaque can narrow or block blood vessels, leading to coronary artery disease and an increased risk of heart attacks and strokes. Diabetes can lead to microvascular complications, including damage to the small blood vessels in the heart and kidneys. These complications contribute to an increased risk of cardiovascular diseases. Diabetes can cause dysfunction in the endothelium, the inner lining of blood vessels, contributing to the development of atherosclerosis and impaired vascular function. Diabetes is associated with chronic inflammation, which can affect the cardiovascular and respiratory systems. Inflammation is a key factor in the development and progression of diseases. Diabetes often leads to abnormalities in lipid metabolism, resulting in high levels of triglycerides and low-density lipoprotein (LDL) cholesterol. Dyslipidaemia contributes to atherosclerosis and cardiovascular disease.
2. **Physical inactivity.** Physical inactivity can lead to a decline in cardiovascular fitness, characterized by a decreased ability of the heart and lungs to efficiently deliver oxygen to the body's tissues, this can contribute to an increased risk of heart disease. Physical inactivity is linked to the development of atherosclerosis, a condition where plaque builds up in the arteries, restricting blood flow and increasing the risk of heart attacks and strokes. Lack of exercise can lead to muscle weakness, including the muscles of the heart. This weakness may contribute to heart failure over time. Physical inactivity is a significant contributor to weight gain and obesity. Obesity is itself a risk factor for various cardiopulmonary diseases, including heart disease and respiratory issues.
3. **Age**. Aging can lead to changes in the structure and function of heart valves, potentially contributing to valvular heart diseases. Physical inactivity is a significant contributor to weight gain and obesity. Obesity is itself a risk factor for various cardiopulmonary diseases, including heart disease and respiratory issues. Blood vessels naturally become less elastic with age, leading to an increased risk of hypertension. Untreated hypertension is a major risk factor for heart disease and stroke. The risk of heart failure increases with age. Changes in the heart's structure and function over time can contribute to its reduced efficiency in pumping blood.
4. **Family history**. Family history can be a significant risk factor for the development of cardiopulmonary diseases. It indicates that there may be a genetic predisposition, meaning certain traits or conditions associated with these diseases may run in families. Genetic factors play a role in determining an individual's susceptibility to certain cardiopulmonary conditions. If close blood relatives (parents, siblings) have a history of heart disease, stroke, or pulmonary conditions, it may suggest a genetic predisposition. The clustering of cardiopulmonary diseases within families is often observed. Families may share not only genetic factors but also similar environmental and lifestyle factors that contribute to the risk of these diseases.
5. **Alcohol consumption**. Excessive or heavy alcohol consumption is associated with a significantly increased risk of both heart disease and cardiomyopathy (weakening of the heart muscle). Heavy alcohol use can raise blood pressure, cause irregular heart rhythms, and contribute to cardiomyopathy, which can lead to heart failure. Heavy alcohol use, or "binge drinking," can increase the risk of atrial fibrillation (AFib), an irregular and often rapid heartbeat. AFib can lead to stroke and other heart-related complications.
6. **Air pollution.** Air pollution is a well-established and significant risk factor for cardiopulmonary diseases. It can have a detrimental impact on both the heart and lungs. Particulate matter consists of tiny airborne particles, such as PM2.5 (particles with a diameter of 2.5 micrometres or smaller) and PM10. These particles can be inhaled into the lungs and even penetrate into the bloodstream. Prolonged exposure to PM is associated with an increased risk of heart attacks, strokes, and exacerbations of lung diseases like asthma and chronic obstructive pulmonary disease (COPD).

**Cardiopulmonary conditions**

1. **Coronary Artery Disease**. It occurs when the coronary arteries, which supply blood to the heart muscle, become narrowed or blocked due to the buildup of plaque, a waxy substance made up of cholesterol, fat, calcium, and other substances. This buildup of plaque is called atherosclerosis, and can lead to chest pain (angina) and heart attacks.
2. **Heart failure**. Heart failure occurs when the heart is unable to pump blood effectively, leading to a reduced supply of blood and oxygen to the body's tissues. It can result from various heart conditions, including coronary artery disease, high blood pressure, and heart valve disorders.
3. **Heart valve disorder.** Problems with heart valves, such as stenosis (narrowing) or regurgitation (leakage), can affect blood flow within the heart and lead to heart problems. Regurgitation: Regurgitation occurs when a valve does not close properly, allowing blood to leak backward through the valve. This can cause the heart to work harder to pump blood and can eventually lead to heart failure. Stenosis: Stenosis occurs when a valve opening becomes narrowed, restricting the flow of blood through the valve. This can also cause the heart to work harder and can lead to other problems, such as shortness of breath and fatigue.
4. **Asthma.** Asthma is considered a pulmonary (lung) condition rather than a primary cardiovascular condition, but it is often associated with cardiopulmonary effects due to its impact on both the respiratory and cardiovascular systems. Asthma is characterized by inflammation and narrowing of the airways, leading to symptoms such as wheezing, coughing, and shortness of breath. These respiratory symptoms can stress the heart and impact overall cardiopulmonary function
5. **Pulmonary hypertension.** Pulmonary hypertension is defined as mean pulmonary artery pressure (mPAP) of 20 mm Hg or higher at rest, as measured by right heart catheterization. It is characterized by high blood pressure in the pulmonary arteries, which are responsible for carrying blood from the heart to the lungs for oxygenation. The elevated pressure in the pulmonary arteries can lead to increased stress on the right side of the heart, as it has to work harder to pump blood against the resistance of the pulmonary circulation. Over time, this can cause the right heart to become enlarged and weakened, leading to right heart failure.
6. **Pulmonary embolism.** A pulmonary embolism (PE) is the blockage of one or more pulmonary arteries by a blood clot, fat, air, or another substance. The obstruction restricts blood flow to the lungs, potentially leading to severe complications. A pulmonary embolism can stress the right side of the heart, as it has to work harder to pump blood through the obstructed pulmonary arteries. This strain on the heart can lead to right heart dysfunction and failure.
7. **Lung cancer.** Lung cancer begins in the lungs and can lead to the development of tumours that affect lung function. These tumours can obstruct airways, leading to symptoms such as coughing, shortness of breath, and chest pain.
8. **Chronic obstructive pulmonary disease**. It is characterized by chronic airflow limitation and is primarily a pulmonary (lung) condition, but it also has significant effects on the ccardiovascular system. Chronic obstructive pulmonary disease primarily affects the lungs by causing chronic bronchitis and emphysema, leading to the narrowing of airways and damage to lung tissue
9. **Cardiomyopathy.** Cardiomyopathy is a disorder of the heart muscle, where the heart muscle becomes weakened, enlarged, or rigid, leading to impaired heart functionCardiomyopathy affects the heart's ability to pump blood effectively, leading to symptoms such as fatigue, shortness of breath, and swelling in the legs and ankles. The impairment of heart function can result in reduced blood flow to the lungs, causing congestion and fluid accumulation, leading to pulmonary symptoms such as pulmonary edema or pleural effusion.
10. **Arrhythmias.** Arrhythmias, which are irregular heart rhythms, are a cardiopulmonary condition because they primarily affect the heart (cardio) but can have significant consequences for the pulmonary (lung) and overall circulatory system. Arrhythmias can disrupt the normal coordination of the heart's electrical signals, leading to various complications. Arrhythmias can affect the heart's ability to pump blood effectively, potentially reducing the cardiac output. This can result in insufficient blood flow to the lungs and the rest of the body.

**References**

* Bays, H. E., Kulkarni, A., German, C., Satish, P., Iluyomade, A., Dudum, R., Thakkar, A., Rifai, M. A., Mehta, A., Thobani, A., Al-Saiegh, Y., Nelson, A. J., Sheth, S., & Toth, P. P. (2022). Ten things to know about ten cardiovascular disease risk factors – 2022. American Journal of Preventive Cardiology, 10.
* Agmon, Y. Khandheria, B., Meissner, I., Schwartz, G., Petterson, T., O'Fallon, W., Whisnant, J., Wiebers, D., & Seward, J. (2002). Relation of coronary artery disease and cerebrovascular disease with atherosclerosis of the thoracic aorta in the general population. The American journal of cardiology, 89 3, 262-7.
* Fichter, J., Bauer, D., Arampatzis, S., Fries, R., Heisel, A., & Sybrecht, G. (2002). Sleep-related breathing disorders are associated with ventricular arrhythmias in patients with an implantable cardioverter-defibrillator. Chest, 122 2, 558-61.
* Slater, W., Lampert, S. Podrid, P. & Lown, B. (1988). Clinical predictors of arrhythmia worsening by antiarrhythmic drugs. The American journal of cardiology, 61 4, 349-53.
* Minto, C., Bauce, B., Calore, C., Rigato, I., Folino, F., Soriani, N., Hochdorn, A., Iliceto, S., & Gregori, D. (2015). Is Internet use associated with anxiety in patients with and at risk for cardiomyopathy?. American heart journal, 170 1, 87-95, 95.e1-4 .
* Stein, P., Willis, P., & DeMets, D. (1981). History and physical examination in acute pulmonary embolism in patients without preexisting cardiac or pulmonary disease.. The American journal of cardiology, 47 2, 218-23.
* Burke, C., Glanville, A., Morris, A., Rubin, D., Harvey, J., Theodore, J., & Robin, E. (1987). Zaiman, A., Podowski, M., Medicherla, S., Gordy, K., Xu, F., Zhen, L., Shimoda, L., Neptune, E., Higgins, L., Murphy, A., Chakravarty, S., Protter, A., Sehgal, P., Champion, H., & Tuder, R. (2008). Role of the TGF-beta/Alk5 signaling pathway in monocrotaline-induced pulmonary hypertension.. American journal of respiratory and critical care medicine, 177 8, 896-905
* Pulmonary function in advanced pulmonary hypertension.. Thorax, 42, 131 – 135